CLAIMS

1. A valve train for an internal combustion engine, comprising:

a valve operating cam rotating around a rotational center line in synchronism with a rotation of an engine;

an engine valve including at least one of an inlet valve and an exhaust valve;

a transmission mechanism for transmitting a valve drive force of the valve operating cam to the engine valve so as to operate the engine valve in open and close states, the transmission mechanism including;

a primary oscillating member oscillating about a primary oscillating center line;

a secondary oscillating member oscillating about a secondary oscillating center line through abutment with the primary oscillating member so as to transmit the valve drive force via the primary oscillating member to the engine valve, and

a holder supporting the primary and secondary oscillating members thereon in an oscillatory fashion;

wherein the primary and secondary oscillating center lines oscillate together with the holder, and

a drive abutment portion of the primary oscillating member abuts with a follower abutment portion of the secondary oscillating portion;

a driving mechanism for driving the holder so as to control valve properties including opening and closing timings and maximum lift amount of the engine valve in accordance with a position of the holder which is driven by the driving mechanism,

wherein the holder oscillates about a holder oscillating center line which differs from the rotational center of the valve operating cam in response to the operation of the driving mechanism,

a cam profile having a lost motion profile for maintaining the engine valve in the closed state by abutting the drive abutment portion with the follower abutment portion and a drive profile for driving the engine valve in the open state is formed on at least one of the drive and follower abutment portions, and

in a sectional shape of the lost motion profile in a plane which intersects at right angles with the primary oscillating center line is an arc-like shape of which center is the primary oscillating center line.

2. The valve train for the internal combustion engine as set forth in Claim 1, wherein the primary oscillating member has a cam abutment portion which abuts with the valve operating cam,

the secondary oscillating member has a valve

abutment portion which abuts with the engine valve,

a primary intersection point is defined as a point intersecting a plane which intersects at right angles with the holder oscillating center line and the primary oscillating center line,

a secondary intersection point is defined as a point intersecting a plane which intersects at right angle with the holder oscillating center line and the secondary oscillating center line, and

a distance between the holder oscillating center line and the primary intersection point is greater than a distance between the holder oscillating center line and the secondary intersection point.

3. The valve train for the internal combustion engine as set forth in Claim 1, wherein the holder includes:

an operative portion on which a drive force of the driving mechanism is applied;

a base portion which extends from the holder oscillating center line toward the operative portion, and having a secondary support portion supporting the secondary oscillating member thereon in an oscillatory fashion; and

a projecting portion projecting from the base portion to the valve operating cam, and having a primary

support portion supporting a primary oscillating member thereon in an oscillatory fashion,

wherein the primary and secondary support portions are disposed between the holder oscillating center line and the operative portion in a direction which intersects at right angles with a plane which includes a cylinder axis of the internal combustion engine and which is parallel to the rotational center line.

4. The valve train for the internal combustion engine as set forth in Claim 1, wherein the valve operating cam is a primary valve operating cam made up of one of an inlet cam and an exhaust cam which are provided on a camshaft, and

the engine valve is a primary engine valve adapted to operate opening and closing operations by the primary valve operating cam and made up of one of the inlet valve and the exhaust valve,

the valve train further comprises:

a tertiary oscillating member adapted to be oscillated by a secondary valve operating cam made up of the other of the inlet cam and the exhaust cam so as to actuate a secondary engine valve made up of the other of the inlet valve and the exhaust valve to operate open and close state; and

a support shaft which supports the tertiary oscillating member in an oscillatory fashion, and

wherein an accommodation space in which the support shaft is accommodated is formed in the holder.

5. The valve train for the internal combustion engine as set forth in Claim 4, wherein the accommodation space is formed in the primary oscillating member in which the drive abutment portion has the cam profile, and is located at a position defined between the primary oscillating center line and the lost motion profile in a radial direction which radiates from the primary oscillating center line as a center.

6. The valve train for the internal combustion engine as set forth in Claim 1, wherein the valve operating cam is a primary valve operating cam made up of one of an inlet cam and an exhaust cam which are provided on a camshaft, and

the engine valve is a primary engine valve adapted to operate opening and closing operations by the primary valve operating cam and made up of one of the inlet valve and the exhaust valve,

the valve train further includes:

a tertiary oscillating adapted to be oscillated by a

secondary valve operating cam made up of the other of the inlet cam and the exhaust cam so as to actuate a secondary engine valve made up of the other of the inlet valve and the exhaust valve to operate open and close states; and

a support shaft which supports the tertiary oscillating member in an oscillatory fashion, and

wherein the accommodation space in which the support shaft is accommodated is formed in the primary oscillating member in which the drive abutment portion has the cam profile, and is located at a position defined between the primary oscillating center line and the lost motion profile in a radial direction which radiates from the primary oscillating center line as a center.

7. A valve train for an internal combustion engine comprising:

a valve operating cam rotating around a rotational center line in synchronism with a rotation of the engine,

an engine valve including at least one of an inlet valve and an exhaust valve;

a transmission mechanism for transmitting a valve drive force of the valve operating cam to the engine valve so as to operate the engine valve in open and close states, the transmission mechanism including:

a primary member which abuts with the valve operating cam;

a rocker arm which oscillates about an oscillating center line by virtue of abutment with the primary member, and having a valve abutment portion having a valve abutment surface which abuts with the engine valve thereon; and

a holder supporting the rocker arm in an oscillatory fashion and oscillating about a holder oscillating center line which differs from the rotational center line of the valve operating cam in response to the operation of the drive mechanism,

wherein the oscillating center line oscillates together with the holder, and

the rocker arm whose oscillating position relative to the holder is regulated by the primary member,

a driving mechanism for driving the holder so as to control valve properties including opening and closing timings and maximum lift amount of the engine valve in accordance with a position of the holder which is driven by the driving mechanism,

wherein in a rest state which is defined where the primary member which is in abutment with the valve operating cam abuts with the rocker arm, and where the

rocker arm does not oscillate relative to the holder, a sectional shape of the valve abutment surface on a plane which intersects at right angles with the holder oscillating center line is an arc-like shape which is formed about the holder oscillating center line.

8. The valve train for the internal combustion engine as set forth in Claim 7, wherein the primary member has a cam abutment portion which is brought into abutment with the valve operating cam and constitutes a primary rocker arm which is caused to oscillate about a primary oscillating center line, and

the rocker arm constitutes a secondary rocker arm.

9. The valve train for the internal combustion engine as set forth in Claim 8, wherein the holder oscillating center line intersects at right angles with the valve abutment portion of the secondary rocker arm which is in the rest state.

10. The valve train for the internal combustion engine as set forth in Claim 8, wherein an operative portion on which a drive force of the drive mechanism acts is provided on the holder at a location thereof which is farthest apart from the holder oscillating center line on

a plane which intersects at right angles with the holder oscillating center line.

11. The valve train for the internal combustion engine as set forth in Claim 8, wherein the primary rocker arm is supported on the holder in an oscillatory fashion, and

as an oscillating position of the holder approaches a predetermined position where a valve operating property is obtained where the maximum lift amount becomes maximum, a cam abutment position where the cam abutment portion and a cam lobe portion of the valve operating cam abut with each other approaches a specific straight line which passes through the holder oscillating center line and the rotational center line on the plane which intersects at right angles with the holder oscillating center line.

12. The valve train for the internal combustion engine as set forth in Claim 8, wherein the primary rocker arm is supported on the holder in an oscillatory fashion in such a manner that the primary oscillating center line oscillates together with the holder,

wherein one of a drive abutment portion of the primary rocker arm and a follower abutment portion of the secondary rocker arm which are brought into abutment with

each other has a cam profile having, in turn, a lost motion profile which holds the engine valve in the closed state through abutment with the other abutment portion of the drive abutment portion and the follower abutment portion and a drive profile which puts the engine valve in the open state, and

when the holder oscillates in an oscillating direction in which the holder moves apart from the rotational center line, a cam abutment position where the valve operating cam abuts with the cam abutment portion shifts, and at the same time an arm abutment portion where the cam profile abuts with the other abutment portion shifts in a direction in which the maximum lift amount is reduced and in a direction in which the arm abutment position moves apart from the rotational center line.

13. The valve train for the internal combustion engine as set forth in Claim 2, wherein the valve abutment portion is provided with an adjusting unit which adjusts a valve clearance defined between the engine valve and the valve abutment portion.

14. The valve train for the internal combustion engine as set forth in Claim 1, wherein the driving mechanism is

provided on at least one of a cylinder.

15. The valve train for the internal combustion engine as set forth in Claim 1, wherein the driving mechanisms are provided on cylinders, respectively.

16. The valve train for the internal combustion engine as set forth in Claim 1, wherein the holders provided in each cylinders are formed to be integral.